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OBSERVATIONS
ON
INJURIES OF JOINTS,
AND
THEIR TREATMENT.

By RUTHERFORD ALCOCK, Esq., K.C.T., &c.

LATE DEPUTY INSPECTOR-GENERAL OF HOSPITALS WITH THE AUXILIARY
FORCES OF PORTUGAL AND SPAIN;
AND LECTURER ON SURGERY.

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READ APRIL 28TH, 1840.

FIRST PART.

AMONG the complicated injuries which have come under my care, in great numbers, during the last ten years, cases in which the articulations are implicated in the first instance, or subsequently to the receipt of a wound or injury, by the extension of diseased action, have attracted much of my attention and careful consideration. It always seemed to me, that this important class of cases had met with much less attention, particularly from surgeons in civil practice, than they merited, by their complicated character, and the frequency of fatal results, both as regarded the life and the limb of the patient.

On wishing to compare the results of my own experience with that of others, I have been still more forcibly struck with the meagreness of the materials bearing any reference to injuries of joints. These, too, are scattered in isolated fragments through a great number of works, Medical Journals, Transactions, &c. I have not found any monograph on the subject ; and when all the fragmental information is gathered together, no satisfactory or conclusive classification of the various kinds of injuries, or definition of principles of treatment, in reference to their respective characters, could be formed from such data.

This, it must be allowed, is a serious evil ; and I have been led, in consequence, to make an attempt to supply the omission by the present contribution to the surgical pathology of joints.

In reference to what has been already done, a few brief observations will suffice. Hey merely relates two or three cases, chiefly of incised wounds, the edges of which being brought together, and treated antiphlogistically, did well ; and one badly lacerated wound of arm, inflicted by a garden roller passing over it.

In none of the various *Memoires de Chirurgie*, Encyclopædias, or Surgical Dictionaries, have I found any but the most brief allusions to the subject. In the German, American, French, and English Medical Journals, a few cases and isolated observations are to be met with ; but the little that has been done towards fixing principles of treatment, and

classifying these injuries in reference to such principles, is to be found in the works of Boyer, Larrey, Guthrie, Hennen, Thomson, and Dupuytren.

Although many are the facts, the observations, and opinions, which from these sources may be collected, yet they are, for the most part, as I have observed, fragmental, often at variance with each other, and requiring ample personal experience to enable the reader to frame anything like comprehensive and consistent views from them, which might embody into a system these injuries, and establish certain principles for their treatment. There are many difficulties attending any attempt of this nature ; for while it is necessary to retain the facts which are sufficiently numerous and defined to be generalized, it is not less essential that all cases should be carefully distinguished which are unusual and exceptional, and therefore unfit and unsafe guides or data on which to found principles of practice for general application. Nothing can be more fatal to the advancement of surgical science, or more fraught with mischief, than a hasty generalization of a few facts, many of which may prove to be mere exceptions to a more general and utterly unheeded principle.

In the class of injuries under consideration, this danger is most especially evident. Many are the extraordinary and most unlooked-for successes attending the treatment of forlorn cases of injured joints. Were general rules or principles of treatment to be founded on these cases, which are but

units among thousands giving contrary results, and were no reference made to those greater numbers, which enlarged experience shows must perish in vain attempts to save limbs, an immense sacrifice of life and increase of human suffering would inevitably follow.

In all complicated injuries of the extremities, the chief difficulty is, to decide upon the cases which demand amputation as a primary measure, and those in which the attempt to save the limb may be judiciously made. By a limb saved, I do not mean one with the wounds healed, having nevertheless the extremity contracted, bent, motionless, or otherwise useless ; cases, which by a loose kind of phraseology, are often termed “limbs saved.” The object of saving a limb is that it may be useful. If this is not the result, the member, by merely hanging to the body of the patient, is lost in my estimation, as truly as if amputated ; but with the additional circumstances of being converted into a source of misery to the sufferer, an impediment to the free motion of the rest of the body, and often a cause of irremediable ill-health. Such cases I hold to be among the worst specimens of bad and injudicious surgery.

But this is not the *only* question to be solved in these injuries. Occasionally the excision of the articulating end of a bone, and other operative means, may obviate the necessity of amputation, by removing the seat of injury, and yet a useful limb be preserved. It is of the utmost importance to define

what are these operative means, and in what cases and circumstances they are applicable. On this part of the subject, the majority of writers on domestic surgery are silent, or nearly so.

With respect to the first question of amputation, which has attracted much attention, the definitions of the classes of injury are few, and, I am inclined to believe, so general and vague, as in some instances to lead to misconception and error of the most mischievous kind. Thus Messrs. Larrey and Guthrie both state generally, that "if the articular heads are much broken, ligaments, &c., lacerated, they are cases for primary amputation." And also, that when the ball is lodged in the thickness of the articular head, and not easily extracted, amputation is to be resorted to. This rule I hope to be able to show requires limitation, and the injury described ought not to be classed with those indubitably requiring immediate amputation. And again: "I most solemnly protest," says Mr. Guthrie, "I do not remember a case to have done well in which I knew the articulating end of the femur or tibia to be fractured by a ball passing through the joint." However correct as a general rule, this, like the one preceding, is somewhat sweeping; and, unless certain distinctions be made, is calculated to lead to amputation in cases of this class, when a useful limb might be saved.

Dr. Hennen lays it down unhesitatingly also, as a law of military surgery, that no lacerated joint, particularly the knee, ankle, or elbow, should ever leave

the field unamputated. I purpose to show that this rule includes many cases where such practice would neither be judicious or justifiable. Mr. Guthrie makes an exception of fractures of the patella, and Larrey enforces an additional doctrine, that when a large ginglymoid joint has been extensively opened with a cutting instrument, and *blood is extravasated* into the joint, immediate amputation is necessary. I feel strongly, from the results of my own experience, the necessity of protesting against this class of injuries being, without reservation, included with those unequivocally requiring immediate amputation. Many cases of this nature must occur, obviously requiring such a measure ; but some may be saved, and, at all events, reserved in that hope, subject to the chance of a secondary amputation, should the progress of the case be unfavourable, without any great increase of peril to life.

Dr. Thomson, in his Report of Observations made in the Military Hospitals of Belgium,—for to the military surgeons I am compelled to refer, almost exclusively, for any information, on this subject,—defines another class, and lays down a rule, which I believe also, from observation, to be unnecessarily destructive to limb.

He says : “ Musket-balls, in passing through the femur, near to the knee-joint, produce fissures of the condyles, which generally communicate with the articulation. These cases, like those in which the bullets have passed directly through the joint, *require immediate amputation.*”

Dupuytren, in his “*Traité Theorique et Pratique des Blessures*,” confirms one of the observations I have already made against a sweeping rule for amputation in fractured ends of bones, by asserting that in cases where balls pass through the osseous and spongy ends of bones, merely making a hole, the articulation may often be saved ; that is, he defines a class of injuries coming within the more general heads of those described by Messrs. Larrey, Guthrie, and Thomson, in which their rule of practice, if adopted, would be erroneous, and unnecessarily destructive.

M. Dupuytren, in reference to this subject, only further alludes to the necessity of amputation, when an articulation is completely torn and spoiled.

In reference to the second question, viz. the excision of articulating ends of bones, the graver injuries of joints were, long, too commonly considered to offer only two alternatives, to amputate, or to save the limb without operation. Improvements in surgical science, and the ample opportunities afforded by the great wars from 1790 to 1815, of testing bolder plans of treatment, have demonstrated that the surgeon’s resources are by no means so limited. And in order to save time, and dismiss this part of the subject at once, while I glance at the opinions and facts of others, I will add the results of my own observation.

Mr. Guthrie has some remarks upon the inattention of the medical department of the British army, during the peninsular war, to the applicability of

the operation of excision in a great number of cases where, as often happens, the head and neck alone are injured. I had, in a somewhat more limited sphere, to regret, among well-educated medical men, who had studied, within so late a period as the last twelve or fifteen years, a similar disposition to remove at once the limb, if the head of the bone was implicated. I have several preparations giving admirable specimens of injuries of the shoulder and elbow, where a limb might probably have been saved at the expense of a portion of the articulating ends or surfaces.

Dr. Thomson, in his "Observations" on the cases resulting from the Battle of Waterloo, although he alludes to many severe injuries, where the attempt was making to save the limb, does not speak of excision of the head, or its removal, in any one instance. Although he proves, therefore, as Mr. Guthrie had it at heart to show, in another part of his work, that all cases were not indiscriminately submitted to the amputating knife, he certainly does not tell us of the adoption of the operative means, by which alone the treatment of severe fractures into the joint is likely to be followed by success.

Excision of the head of the femur has been practised. M. Paillard, in his "*Relation Chirurgicale du Siège d'Anvers*," gives an example of resection of the head of the thigh bone for a comminuted fracture of the neck,—six inches of the bone, including the head and neck, were removed with very trifling

loss of blood. During the first few days, some chances of success were observed; but the limb quickly afterwards became gangrenous, and the patient died on the ninth day. Mr. White, of Manchester, was the first to propose this operation, about the middle of last century. One case only of its actual performance had been related before M. Seutin's, by an American, and was not considered, I believe, as very certainly authentic. The result of M. Seutin's case is not likely to lead many to perform an operation which, I cannot but think, very little calculated to save a useful limb under the most favourable circumstances. I believe, however, that Mr. White, Surgeon to the Westminster Hospital, has performed a similar operation for carious disease of the head of the femur, and with good result. In wounds of the shoulder-joint, Larrey speaks of ten cases in which he avoided amputation by extracting or removing the head of the humerus; one died of fever, two of scrofula, and one of plague. In some there was anchylosis, in others a species of joint.

In 1794, M. Percy showed, in Paris, nine successful cases, where the head of the humerus had been removed; and Larrey again relates a case where the top of the shoulder was struck by a four-pound shot, merely breaking the skin superficially, but fracturing underneath the head of the humerus, the scapular end of clavicle, the acromion and coracoid processes. He cut down upon the broken fragments, and removed them, including the head of the humerus. The wounds cicatrized, and the arm

anched at the shoulder, by the gradual approximation of the shaft. In another similar instance there was an artificial joint formed, and slight movement in every direction, although the arm seemed to have less strength than existed in the former case, where there was ankylosis. Mr. Guthrie also speaks of similar cases of cannon-shot injuries occurring in the British army; but all were fatal. He relates, however, several cases from musket-shot, where arms were saved by removing the head from the cavity, together with any other fragments of the neck.

These facts are quite sufficient to prove that this operation, first proposed as a means of saving an arm in disease,—and the first case was made known by White, of Manchester, in 1769, who had recommended it for caries of the joints, arising from spontaneous disease,—is perfectly applicable to cases of severe fracture and injury to the bones of the articulation. They prove that even the fearful injuries inflicted on the shoulder by cannon-shot may sometimes be so treated with success, although, it is to be feared, with a greater risk to life than that arising from immediate amputation. But in musket-shots merely shattering the head of the bone, the operation of excision of the head may be resorted to, with the confident anticipation of success in a majority of cases. This all past experience sufficiently confirms.

This operation, as applied to the knee-joint, subjects the patient to imminent risk, and the result

can never be very satisfactory. This opinion alike applies to cases of caries and of injury. The cases that are on record by no means bear out the views of those who have recommended its adoption. With the opinion I have just expressed, I have never recommended or performed the operation, although a great number of cases favourable for it have fallen under my observation, had I thought the operation promised any success commensurate with the risk to life and chances of a useless limb, even if the patient should recover.

To conclude at once with the articulations of the lower extremity, in reference to these operative means, I will observe that in injuries of the ankle, excision, whether of the astragalus or the end of the tibia, may form a resource; and examples are on record, when both the one and the other have been removed with success. If a shot, however, pass directly through the articulation, splintering articulating surfaces of both tibia and astragalus, I believe amputation to be almost invariably indicated. The excision or removal of the whole or portions of one of the articulating surfaces forming the ankle joint will more frequently be found expedient in the dislocations attended with laceration occurring in civil life,* where it is often impossible to return the pro-

* I have been watching a case of partial excision of the external malleolus in a severely lacerated and partially fractured ankle-joint. Since this paper was read, the patient is under the able hand

jecting parts to their proper position, than to gunshot injuries more extensively shattering the bone, and contusing all the parts in the vicinity.

Very serious injury of the elbow-joint often admits of the limb being saved, even after portions of the articulating ends may have been removed, or the olecranon dissected out, without the arm being rendered useless. Finally, excision of the ends of the articulating bones may be practised with advantage in a great number of cases in which those parts alone are involved. This operation has been performed many times with good success in cases of disease; it is still more applicable to injuries. Portions of the articulating surfaces I have dissected out with the happiest result. Much valuable information relative to the operation of excision in the elbow will be found in a work on carious joints, edited by Dr. Jeffray, and also in a treatise of Mr. Symes, of Edinburgh. This is, however, neither so simple an operation in the performance, nor so likely to do well in the end, as similar cases in the shoulder-joint, which, of all the articulations, is the one to which this operation is best adapted. Of the total excision of the articulating ends of the elbow, I find no instance in the annals either of British or French military surgery, although domestic surgery has furnished us with many examples for dis-

of Mr. White, of Westminster. The result is most satisfactory, the progress of the case having been marked by scarcely any constitutional disturbance.

ease. This can only have arisen from the indisposition of medical men to apply the principle of the operation to cases of injury.

The wrist alone remains for consideration in reference to excision. It is often difficult to decide upon the course to be adopted in wounds and lacerations of this articulation. Patients occasionally recover from very severe injuries, such as the passage of a musket-ball through the carpal bones, or the laceration of a saw passing into the articulation with the hand. (See Case X.) Yet these are cases at best eminently uncertain in their results ; and although much may be adventured, but little should be promised or hoped. Excision of the end of the radius, the removal of a dislocated carpal bone, or of the head of a metacarpal bone, may occasionally be adopted, and with success, to prevent the loss of a hand. It is impossible, however, to predict, with any certainty, the degree of inflammatory and suppurative action which may ensue ; and on this chiefly hangs the issue of the case.

If there be crumbling of one or more of the carpal bones, provided the tendons are not divided across, these fragments may be removed, and an attempt made to save the hand. But if there be comminution involving the greater part of the articulation, instead of its lateral extremities merely, it rarely happens that the tendons are not extensively torn across also ; and then amputation would better be performed at once, and no attempt made by excision to remedy the mischief.

Of the six principal articulations, I have to observe therefore, that excision of the ends of bones offers a great and valuable resource in four, viz., the shoulder, elbow, wrist, and ankle: and in the order here given, is it most applicable. The hip and the knee are not articulations in which this operation seems to be expedient. The most favourable cases are those in which the head of the humerus alone is implicated, and that by a musket-shot.

The greatest amount of information on injuries of the articulations which I have found collected in an available form in any one work, is in Mr. Guthrie's *Treatise on Gun-shot Wounds*. But as far as I have been able to ascertain, valuable as the facts and observations may be, which have been placed on record by the military surgeons of the past and present century, on complicated injuries of joints, there is yet wanting a treatise which shall fulfil the object I have in view in this paper.

I do not here make any reference to the valuable work of Sir Astley Cooper on *Dislocations*. In that treatise any complicated lacerations or wounds of joints are incidental, and only form the exceptions, as it were, to those cases which form the bulk of the work, devoted simply to the displacement of articular surfaces—injuries which take place, in the great majority, without accompanying wounds, fractures, or the lodgment of foreign bodies.

This brief retrospective glance will, I hope,

serve to show, that the attempt to establish certain fixed and comprehensive principles of treatment, in reference to a maturely digested classification of the various kinds of injury, is not a labour of supererogation.

SECOND PART.

GENERAL RESULTS.

Before I proceed to the classification of cases and reference to individual examples, a few observations will not be misplaced on some of the more striking general results of these injuries with regard to the frequency of their occurrence in military practice, and to the treatment, progress, and termination of cases of injury to the articulations generally.

I was first led to these results by a careful analysis of about one hundred cases of severe injury to joints, detailed notes of which I had preserved, for a period when more leisure, than my duties at the time allowed, should enable me to undertake the labour. Many of these results are of interest and practical importance. Such of them as are numerical I have thrown into a tabular form, as the most condensed mode of expressing them. I cannot help observing,

that were statistics of the progress and results of diseases and injuries more closely and frequently applied, wherever large numbers of cases are under observation, much valuable information would be obtained that is now lost to the profession,—information too that by no other means can be made practically to bear on classes of maladies, and their principles of treatment. Doubtless, if figures are employed otherwise than conscientiously, and with the greatest care and judgment, to avoid classing together dissimilar facts under parallel heads, they may be made a more pregnant source of error than any argument or description by words ; but this can in no degree militate against their proper use, and their importance when so applied.

The results of these tables, which, for the sake of accuracy and perspicuity, include only gun-shot wounds, may most conveniently be adverted to, under separate heads. Although the number of injuries, such as occur in civil life, which have come under my notice during the last twelve years, have been very considerable, yet I could not from my notes attempt to include *all*, and, whatever the number collected, they would, at best, be fragments, affording, therefore, the data of no one complete series. This is precisely a danger that it behoves any one resorting to statistics for the decision of scientific questions, to avoid. If *all* the cases of a given period be included, they form sufficient grounds for just conclusions ; but if one case be omitted, the whole

return is falsified ; it may be a death or a cure, or an amputation ; but whatever the termination, its omission alters the legitimate conclusion. How much more incorrect must be a return, where it is impossible to state how many may have been omitted ? It is worse than useless, however accurate may be the details actually produced.

RETURN, No. I.—*Results of Gun-shot Fractures, involving Articula-
Cases not operated on, including the*

Site and Nature of Injury.	Intermediate Amputations.									Secondary Amputations.								
	Number of Cases.			Cured.			Died.			Number.			Cured.			Died.		
	Joints prima- rily involved.	Joints secon- darily invol- ved.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.
HIP. External Circumstances																		
Musket Shot { Favourable . Partially unfav. Unfavourable .																		
Total .																		
SHOULDER.																		
Cannon { Favourable . Partially unfav.																		
Musket { Favourable . Partially unfav. Unfavourable .	1		1				1		1									
Total .	1		1				1		1									
KNEE.																		
Cannon { Favourable .																		
Musket { Favourable .	1		1				1		1	6		6	3		3	3		3
Partially unfav.										1		1		1				
Unfavourable .	2		2				2		2	2		2			2			2
Total .	3		3				3		3	8	1	9	3	1	4	5		5
ELBOW.																		
Cannon { Favourable .																		
Musket { Favourable .	1		1	1		1				1		1		1				
Partially unfav.																		
Unfavourable .																		
Total .	1		1	1		1				1		1		1				
ANKLE.																		
Cannon { Favourable .										1		1		1				
Partially unfav.	1		1	1		1												
Unfavourable .																		
Musket { Favourable .		1	1		1	1												
Partially unfav.																		
Unfavourable .	1		1	1		1												
Total .	2	1	3	2	1	3				1		1		1				
WRIST.																		
Cannon { Unfavourable .																		
Musket { Favourable .										1		1		1				
Partially unfav.																		
Unfavourable .										1		1		1				
Total .										2		2		2				
TOTAL . .	7	1	8	3	1	4	4		4	12	1	13	7	1	8	5		5

tions, Amputations,—including all in two Periods of about one Year each.
Series of Thirteen Months only.

Cases not operated upon.									Total Results of Treatment and subsequent Amputations.			Primary Amputations.			GENERAL RESULT.		
Number.			Cured.			Died.			Cured.			Died.			Cured.		
Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Cured.	Died.	Total.
2	1	1		1	1	2	1	3		1	1	2	1	3		1	3
2	2	4		1	1	2	1	3		1	1	2	1	3		1	4
1		1				1		1				1		1	1	1	2
1	1	1		1	2			1		1	2	1	1	1	3	3	3
1	1	2	1	1	2				1	1	2	1	1	1	2	2	3
3	1	4	1	1	2	2		2	1	1	2	3		3	8	1	14
5	3	8	1	3	4	4		4	4	3	7	8		8	1	1	1
3	1	4	2		2	1	1	2	2	1	3	1	1	2	3	10	19
10		10				10		10				14		14	1	3	5
18	4	22	3	3	6	15	1	16	6	4	10	23	1	24	5	4	18
3	5	8	3	5	8				5	5	10				1		1
2	2	2	1	1	2	1		1	1	1	2	1		1	2	12	2
1	1	2	1	1	2				1	1	2				4	4	6
6	6	12	5	6	11	1		1	7	6	13	1		1	3	4	21
									1		1						
1	1	1		1	1	1		1							1	1	1
									1		1						
1	1	2		1	1	1		1	3	2	5	1		1	1	1	8
2	2	4	2	2	4				3	2	5					1	1
1			1	1	2				1		2					5	5
1			1	1	2				2		2					1	1
4	2	6	4	2	6				6	2	8					2	2
34	16	50	13	14	27	21	2	23	23	16	39	30	2	32	17	11	99

RETURN, No. II.—*Results of Gun-shot Fractures involving the Articulation—Including a Period of*

Site and Nature of Injury.	Intermediate Amputations.									Secondary Amputations.								
	Number.			Cured.			Died.			Number.			Cured.			Died.		
	Joints primarily involved.	Joints secondarily involved.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.
HIP.																		
Musket	{ Favourable . Partially unfav. Unfavourable .																	
Total .																		
SHOULDER.																		
Cannon	{ Favourable . Partially unfav.																	
Musket	{ Favourable . Partially unfav. Unfavourable .			1		1			1	1								
Total .	1		1				1	1										
KNEE.																		
Musket	{ Favourable . Partially unfav. Unfavourable .									6	6	3	3	3	3			3
	1		1				1	1	2	1	1	1	1	1	2	2		2
Total .	1		1				1	1	8	1	9	3	1	4	5			5
ELBOW.																		
Cannon	{ Favourable . Partially unfav.																	
Musket	{ Favourable . Partially unfav. Unfavourable .									1	1	1	1					
Total .									1	1	1	1						
ANKLE.																		
Cannon	{ Favourable . Partially unfav. Unfavourable .			1		1	1		1	1	1	1	1					
Musket	{ Favourable . Partially unfav. Unfavourable .				1	1		1	1									
Total .	1	1	2	1	1	2			1	1	1	1	1					
WRIST.																		
Musket	{ Favourable . Partially unfav. Unfavourable .									1	1	1	1					
Total .									1	1	1	1						
TOTAL . .	3	1	4	1	1	2	2	2	11	1	12	6	1	7	5			5

ations,—in Cases Amputated,—in Cases treated without Operation.
about thirteen Months.

Cases not operated upon.									Total results of Treatment and subsequent Amputations.						Primary Amputations.			GENERAL TOTAL.		
Number.			Cured.			Died.			Cured.			Died.								
Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Cured.	Died.	Total.	Cured.	Died.	Total.
2	2	2		1	1		1	1		1	1		1	1				1	1	2
2	2	2				2		2				2		2				2		2
2	2	4		1	1	2	1	3		1	1	2	1	3				1	3	4
1		1				1		1				1		1	1				1	1
1		1				1		1				1		1	2			1		2
1	1	2	1	1	2				1	1	2	1		1	2	2		2	1	3
1															1	1		3		4
3	1	4	1	1	2	2		2	1	1	2	3		3	6		6	8	3	11
5	3	8	1	3	4	4		4	4	3	7	7		7	3	1	4	10	8	18
2	1	3	1		1	1	1	2	1	1	2	1	1	2	1	2		2	2	4
7		7			7			7				10		10	1	2	3	1	12	13
14	4	18	2	3	5	12	1	13	5	4	9	18	1	19	4	3	7	13	22	35
3	5	8	3	5	8				4	5	9				1		1	1		1
2		2	1		1	1		1	1		1	1		1	2		2	11		11
1		1	1		1				1		1					4	4	1	1	2
6	5	11	5	5	10	1		1	6	5	11	1		1	3	4	7	14	5	19
									1		1							1		1
1	1	1		1	1						2	2			1		1	1	1	2
						1		1										2		1
1																				
1	1	2		1	1	1		1	2	2	4	1		1	1		1	5	1	6
2	2	4	2	2	4				3	2	5									
1		1	1		1				1		1							5		5
1		1																1		1
4	2	6	4	2	6				5	2	7							7		7
30	15	45	12	13	25	18	2	20	19	15	34	25	2	27	14	7	21	48	34	82

The Return No. I, embraces all the cases occurring within a given period ; to which I have added all the amputations from such injuries, not only for the same, but during several additional periods. As the periods embraced by the cases and the amputations do not therefore correspond, Return No. II, has been formed, giving all the cases treated or amputated within a given time, *and no others*. Each of the Returns will be found to have its legitimate use.

I have already claimed the attention of the Society to some observations on certain classes of injuries to joints usually met with in the accidents of civil life ; and the object of this paper is to include both those of civil and military life in the general principles which I hope to show sufficient grounds for establishing. Nor can I be charged with any want of judgment, I trust, in thus including both within the limits of the same paper. I can only look upon gun-shot injuries as different from any other class, occasioned by machinery, the fall of weights, the passage of carriage-wheels, &c., inasmuch as they are in general of a *far more complicated and embarrassing nature*. I should not indeed occupy the Society's time by any relation of facts connected with casualties of the field, were I not convinced that any principles of treatment or practice established for them, are not less applicable to all severe and complicated injuries from whatever cause proceeding. It may be safely assumed, that whatever renders more simple and certain in its re-

sults the treatment of the most complicated forms of injury, cannot but tend to diminish any doubt or difficulty attached to cases originally less complicated in character; and that the severest tests to which any principle of treatment can be subjected, are the results of its application to the most complicated injuries. The large numbers of injuries brought at one period under observation in military hospitals, under the same general circumstances and plans of treatment, afford an opportunity and a facility for drawing practical conclusions and statistical results, such as years cannot with equal perfection furnish in any civil hospital.

As all the cases included in the tabular Returns have been admitted in military hospitals, under my sole direction, and treated in accordance with certain general principles, these once explained will apply to all, and prevent a great deal of repetition in relating individual cases, besides leading to the better appreciation of the general results.

I have classed all injuries of joints under three heads. I need merely so far define them at present as to say, that the first comprises those varieties of injury where in the majority of cases the limb may be saved, and where as a general rule it should be a principle of practice to attempt the cure.

The second contains what may be considered a doubtful or intermediate class. It comprises cases in which we find the difficulties both as to the diagnosis and line of treatment are considerably in-

creased. They can be grouped neither like the first class, as injuries in which the attempt to save the limb may be made in the majority with good result ; nor with the third class, where amputation is imperatively indicated from the first, and with as little delay as possible. Each of the subdivisions, therefore, of this class, demands separate and careful consideration : but as they ultimately must require more or less protracted treatment, the same principles adopted for the first class will apply ; and the third class ceases to be an injury of joint by immediate amputation.

In lacerated or incised wounds penetrating the capsule, it has been held matter of the highest importance to exclude the air, and secure, if possible, and by every means, union by the first intention. I have been led, by my observation of these injuries, to a conclusion not quite in accordance with this precept. Although it may safely be admitted as a general principle in surgery, that all wounds should be treated so as to procure the earliest possible union of their edges, this should be understood, in reference to wounds of joints, to apply only so far as the edges can be approximated without violence of any kind, constriction or pressure. I firmly believe that no pressure by bandages, compresses, or by means of strapping, can be applied in the first instance to injuries of joints, without doing mischief, and materially aggravating the inflammation, which, to some extent, must inevitably ensue.

I have found that cold, in the first instance, ap-

plied over the articulation, generally best assists in repressing and controlling the supervening inflammation, and if somewhat later it should become ungrateful to the patient's feelings, it may occasionally be exchanged, with advantage, for warm water dressings: or if the joint has assumed a puffy, swelled and unhealthy appearance,—a state often to be traced to the injudicious use of poultices,—a more tonic and stimulating mode of dressing will generally cause improvement. Of this kind of dressing, the best seem to me either a decoction of aromatic herbs, with the addition of a little wine, or warm camphorated or sweetened wine, which has not been freely adulterated with bad brandy, as are generally most of the wines consumed in England. Such dressing is not used in this country, but is frequently employed in the rest of Europe; and I have no hesitation in stating that I have seen the happiest effects from its use, when more emollient applications, such as poultices, certainly did not arrest, but, on the contrary, appeared to promote the '*engorgement*' of the limb. There is indeed a strong prejudice in this country against such applications, but founded upon theory rather than practice.

These means constantly require to be seconded by the most rigid antiphlogistic treatment—local and general bleeding, and particularly the application of leeches, in large numbers, to the articulation. The skin and the bowels should be made to act freely,

and the most absolute immobility of the joint secured.

The object of all treatment in these cases is very obvious. In the first place, we have to arrest and control inflammation, so as, if possible, to prevent suppuration. But it often happens that all our efforts fail, and inflammation goes on to suppuration. With this result the treatment changes, for its aim is no longer the same. The great object then is, firstly, to prevent the deposit and accumulation of matter in the articulation, which, notwithstanding all that has been said of its bland and innocuous nature, previously to the admission of atmospheric air, quickly erodes all the articulating surfaces, in the generality of cases ; I have seen exceptions, but they are few ; and secondly, to prevent the matter from burrowing among the muscles, extending upwards and downwards, thus involving the whole limb in a suppurative and disorganizing disease.

No sooner, therefore, is suppuration established, than it becomes necessary to devise the best means of obtaining its evacuation, and to secure its draining off, in proportion, or as fast, as it forms. Any fears of the contact of air I cannot but think are out of place. The matter will do more mischief by being allowed to lodge. Counter openings in pendent positions and free incisions, either in the vicinity, or if necessary, through the capsule, should be promptly and boldly practised, together with such regulated

pressure above and below the articulation, as the state of the limb may indicate and allow, in order to counteract the tendency to spread and burrow.

At the same time, the impression on the system, and the general health of the patient requires careful watching. Diarrhœa is of frequent occurrence, and difficult to check. If this be accompanied by hectic fever and great prostration of strength, and the appearances and state of the joint offer no prospect of speedy amelioration, it may become necessary, whatever the original injury may have been, to amputate as the sole chance of safety to the patient.

While the wounds are healing, and the discharge diminishing, the most perfect quiescence, I have taken care, should still be preserved, and for some time after cicatrization ; gentle friction and passive motion may then be tried, very gradually. If the ankylosis resulting be partial, probably considerable motion may be recovered, and some force may be used ; care being taken never to push these measures so far as to induce inflammation in structures still morbidly susceptible. If the ankylosis, on the contrary, be complete, no attempts of this nature should be made ; a bony ankylosis often being the result of the diseased actions that follow a severe injury.

These observations comprise the general principles upon which all the cases included in the tabular Returns were treated. So far as they go, they are applicable to all kinds of wounds or lesions of the

articulations. The modifications that may be required by any peculiarity of injury, are by no means numerous, and generally sufficiently obvious.

The general results of the Tables may now be considered, and they will be most conveniently adverted to under the following heads:—

1. Their proportionate numbers, in relation to other classes of injuries, and of the articulations with each other.

2. Mortality, absolutely and relatively. Number of amputations to which these injuries give rise, and proportionate numbers in different periods.

3. Causes of mortality, with regard to the whole number of deaths, and to the number of deaths from each articulation, considered in relation to amputations at the three periods—primary, intermediary, and secondary, and to cases treated without amputation.

4. Influence of external and collateral circumstances.

1. *Proportionate Numbers, &c.*—These results will be found in Table II. Cases of severe joint injuries fix the attention, and make a stronger impression upon the memory, than many others of less interest, and, at the end of a few years, seem in much larger number than facts bear out. Certainly, had I stated the number according to my impressions only, of the cases of which I had made detailed notes, while under treatment, I should have been inclined to believe their proportion to the whole of the cases

which had fallen under my observation much greater.

Table II. furnishes an accurate statistical record of the whole number of injuries of the articulations, furnished by a series of actions in a little more than twelve consecutive months : it shows the proportionate number in about 1,800 wounded, officers and men, who were treated under my direction in that period.

The average may be stated, therefore, as between 4 and 5 per cent., or about $\frac{1}{2\frac{1}{2}}$ of the whole number of 1,800 wounded ; the injuries to the articulations counting 82. In a return already published* of wounded *men* admitted into the General Military Hospital of San Telmo, in thirteen months, amounting to 1,350, the average is less. In the returns of the different actions it varies from 1 in 30, to 1 in 52; but in these are not included many of the worst joint cases, amputated on the field, which appear in the return as "Field Amputations." I consider, therefore, the Return No. II., formed with the greatest care and accuracy, to give the true average. In the returns already quoted of 1,351 wounded, at San Telmo, the proportion of injuries of the head was 7 per cent. ; wounds of the trunk, penetrating its cavities, between 4 and 5 per cent. ; of fractures of the extremities, about 13 per cent., in which are

* "Notes on the Medical History and Statistics of the British Legion in Spain," 1838.

included the joint cases ; of severe wounds not in these classes, 33 per cent. ; of slight wounds about 44 per cent.

With respect to the relative numbers in the different articulations, of the 82 recorded, nearly one-half are of the knee.

Knee	. 35 :	proportion, 2·342 :	mortality, 22	
Elbow	. 19 :	about $\frac{1}{4}$ 5	
Shoulder	11 :	between $\frac{1}{7}$ and $\frac{1}{8}$ 3	
Wrist	. 7 : $\frac{1}{12}$ 0	
Ankle	. 6 : $\frac{1}{15}$ 1	
Hip	. 4 : $\frac{1}{20}$ 3	
<hr/>				<hr/>
Total	. 82		Total	. 34
<hr/>				<hr/>

2. *Mortality, absolute and relative.*—It required not less than the unanswerable evidence of figures to convince me the mortality was so great, remembering, as I did, many cases of successful result, even when unanticipated. I was scarcely prepared to find a loss of 34 in 82, including in the number treated those injuries which did not, in the first instance, implicate the structure of the joint, but only at some later period, by the progress of diseased actions spreading from the original site of injury. The number of cases in which the joint was primarily and directly implicated amounts to 65 ; 17 were only secondarily affected. Of the 65—

between $\frac{1}{5}$ and $\frac{1}{6}$, 12 were cured with more or less loss of motion and power, but all with some use of their limbs.

$\frac{1}{2\ 2}$, 3 intermediary* amputations were performed, and two patients died.

$\frac{1}{6}$, 11 secondary amputations ; 5 deaths.

$\frac{1}{3}$, 21 primary amputations ; 7 deaths.

Between $\frac{1}{3}$ and $\frac{1}{4}$, 18 died under treatment, while — the attempt was being made

Total 65 to save the limb, either in the hope of success, or, more frequently, from the patient's refusal to submit to amputation. The result, therefore, stands thus—

33 recovered ; 21 with loss of limb ;

32 died ; 18 without amputation ;

7 after primary amputation ;

2 after intermediary ;

5 after secondary.

Total 32

The mortality in the 3 classes stands thus, as regards the whole number of 65 :—

* The term intermediary amputation refers to those performed between the third and twentieth days inclusive,—a period during which the febrile and inflammatory actions have commenced, rarely entirely subsided.

About $\frac{1}{9}$, or 7 died after primary amputation ;

$\frac{1}{9}$, or 7 died after subsequent amputations ;

Between $\frac{1}{3}$ and $\frac{1}{4}$, or 18 died during treatment without operation.

Total 32

These are the positive results, according to the circumstances under which these series of cases were treated, rather than the relative results, or the necessary average mortality of a treatment uncontrolled by such events, or by the patient's will, and directed upon the best principles. It is quite evident that if the 18 cases of death without amputation, and the 14 cases of subsequent amputations,—(assuming them to be unfavourable cases for treatment in the first instance,)—instead of being treated, had immediately been amputated, we should then have had, for result, not a loss of 25, but of one-third, which is the loss from primary amputation : two-thirds, therefore, or 16 out of the 25, would have been saved.

As the tendency of many of the observations which follow is to lead to the saving of limbs rather than to their amputation, by defining cases in which operation, in the first instance, at least, may be judiciously avoided, I feel it the more incumbent to bring forward these general results in the clearest manner.

I will merely further observe here, that where the

joints were directly involved, the number *treated*, that is to say, in which primary amputation was not performed, amounting to 44, present a mortality of 25, considerably more than one-half, whereas the primary amputations cause a loss only of one-third, although naturally performed for the very worst injuries: and while 12 only were cured without loss of limb, 18 died in the vain attempt to save, without, for the most part, offering any fair opportunity of remedying the evil by intermediary or secondary amputation.

Of the intermediary and secondary amputations, where treatment failing to save the limb, amputation offered the only ground of hope for life, 7 died out of 14, amounting to one-half; but of the secondary amputations, properly so called, a fraction less than one-half were lost, 5 in 11. These cases form the forlorn hopes of surgery; all saved are snatched from nearly certain death.

The number lost among those who, notwithstanding the original object of cure failed, yet survived to a proper period, or otherwise gave an opportunity for amputation, is small in relation to 44; the deaths only amount to 7 of those primarily involved, or one-sixth; but to these should be added the 18 deaths during fruitless treatment, and the total loss should be estimated against the one-third dying from primary amputation. This is the only true mode of testing the comparative mortality.

The following are the results of the 17 cases secondarily implicated:—

13 recovered, the greater part with some injury to power, sensation, or motion, but none with useless limbs.

2 died under treatment.

2 underwent amputation ; 1 intermediary, 1 secondary, and both recovered.

Resumé.

15 saved, 2 with loss of limb.

2 died under treatment.

Finally, including both classes of injuries, i. e. those directly, and those only secondarily implicating the articulation, the 82 classified in Return II. give for result—

25 cured without amputation ;

23 cured with loss of limb, 14 after primary, 2 after intermediary, and 7 after secondary — amputation.

48 Total.

—

7 died after primary amputation ;

2 died after intermediary ditto ;

5 died after secondary ditto ;

20 died under treatment, and without amputation.

—

34 Total.

—

In reference to the injured articulations, which lead to fatal terminations, much depends upon certain classes of mechanical or physical causes. 1stly. Upon the degree and nature of the injury ;

2ndly. The extent of articulating surface implicated, and consequently the site; and 3rdly. The favourable or unfavourable nature of external circumstances. These all exercise a strong and abiding influence, as will shortly be shown.

The hip is more rarely the seat of direct injury from foreign bodies than any of the articulations. The result is generally fatal; three in four died; and in the fourth, where recovery took place, the joint itself, there is some reason to suspect, was but remotely affected.

The shoulder is rarely implicated directly by injury without a subsequent operation, amputation, or excision of the head of the humerus, being required. In 11, which occurred in the series of 82, only 2 were cured without amputation; 7 amputations were performed, 6 primary, and 1 intermediary; the latter was unfortunate in its result; all the primary recovered.

By operation, therefore, they do not form so fatal a set of cases as has generally been imagined. In 9 primary amputations, in Return No. I, there was one death; and this operation was performed under very unfavourable circumstances, and the patient subsequently retained in a crowded hospital, with a typhoid fever prevailing. I am inclined to estimate them as a more favourable class of cases than any injuries leading to amputation above the knee.

The injuries of the knee are the most numerous, and with the exception of the hip, the most fatal to life, and generally, at best, leading to the loss of limb:

of 35 of the knee (see Return No. II.), 22 lost their lives, and of the remaining 13 who were saved, 8 lost their legs. After such results, it is little to say that the 5 who recovered preserved good and useful limbs.

The primary amputations (see Table I.) amount to 9, and 4 died: they are decidedly more trying injuries to the system than those of the shoulder, not only by the double shock being greater, as proved by this result, but by the gravity of the actions, to which the original injury gives rise. Thus there were 3 intermediate amputations, and 9 secondary, and only 4 recovered out of the 12, or one-third, two-thirds dying.

Injuries of the elbow stand next in order of frequency, making a total of 19 cases, 5 of which were fatal; 10 were cured without loss of limb, but nearly all with ankylosis, complete or partial; 1 died during the attempt to save the limb, at the 120th day, of angina pectoris; 4 out of 7 primary amputations died, all with disease of chest or liver; 1 secondary amputation recovered.

Deaths, in secondary amputations for injuries of the elbow, are rarely to be anticipated. The cases have not generally deeply implicated the system, or irreparably injured the constitution. The portion of the body removed is small; the shock of the operation, when not superadded to another immediately preceding, but trifling. Nothing, therefore, but some of the accidental complications, occasionally

supervening in all amputations, are to be looked for as probable causes of death.

The ankle is less frequently directly implicated in serious injury than might be expected. Generally, the violence is first received on some part of the leg, which breaks ; thus often saving the articulation below.

In the series of 82, there are but 6 cases ; 1 died, and that from effusion into the serous cavities, anasarca, the limb erysipelatous and gangrenous ; 3 required amputation, 1 primary, 2 intermediary,—all recovered.

The wrist is, upon the whole, more frequently injured, but in no proportion to the knee, and much less often than the elbow or shoulder. In 7 cases included in the series of 82, all recovered ; 1 after secondary amputation.

Although gun-shot fractures of the bones of the hands and feet, for the most part, more or less involve some of the lesser articulations of the phalanges or metacarpus, I have not included any of these cases in the returns of joint injuries : they, in fact, more properly belong to fractures simply. It is surprising, moreover, how often both hands and feet undergo severe injuries, without any direct or serious implications of the articulating surfaces.

In reference to this part of the subject, I may also remark, it should not be lightly presumed, that because a severe injury is inflicted in the immediate vicinity, and the bone even comminuted, that the articulation is either directly, or will of necessity, be

subsequently involved, or, at least, to any dangerous extent. Many cases have come under my care in which excellent and useful limbs have been saved under such circumstances.

I made careful notes of three cases of the wrist, in two of which the radius was broken into fragments, within half an inch of the carpal articulating surface, and yet the joint seemed to escape. In two cases, also, of the knee, in one of which a ball lodged six months in the head of the tibia, immediately beneath the articulation,* without involving it, and another,† where the femur, close to the condyles, had many fragments struck from it, merely causing two or three hair-like fissures into the articulating surfaces. The leg, in this case, was amputated with my concurrence, taking into consideration the extensive laceration of soft parts, probable injury to the popliteal blood-vessels, &c. But, as regards the *injury to the articulation*, it will be evident that the limb, in all probability, might have been saved. This is a case that I have classed among those not necessarily indicating primary amputation.

* In a paper of Dr. Holmes, Assistant Surgeon to the Forces in Canada, published in the Edinburgh Medical and Surgical Journal, July 1840, a case is related where a ball fractured the fibula, and passed through the head of the tibia, without fracture or fissure, involving the joint; and at the end of five weeks, when amputation was performed, to arrest the irritative fever, &c., no inflammation had taken place in the joint.

† The preparation was shown.

In another case of a wound of the elbow, in which a ball passed through the bend of the arm, traversing the exterior of the capsule, although the arm was the subject of secondary amputation for the surrounding disease, the joint itself was found free from any affection. In two cases, also, of the foot, although balls partially traversed the bones of the tarsus and metatarsus, no violent, or, as far as could be determined, no articular mischief of any kind ensued.

3. *Causes of death.*—The causes of mortality in severe injuries to the articulations afford much scope for inquiry ; and questions of great interest and practical importance arise from it. The Return No. I, gives a total of forty-three fatal cases,—a fair number for consideration. They may be advantageously classed under four heads :—

- | | | |
|-------|----|---|
| 1. | 23 | died under treatment for the original injury. |
| 2. | 4 | — after intermediary amputation. |
| 3. | 5 | — after secondary amputation. |
| 4. | 11 | — after primary amputation. |
| <hr/> | | |
| | 43 | Total. |
| <hr/> | | |

If there be any one obvious cause prevailing in many, we may fairly presume that it forms a leading feature of danger in all such injuries. Thus I found in the twenty-three not less than

- 11 died of a wasting discharge and febrile action
—hectic fever chiefly ; the demands on the
constitution great ; the diseased action
unconquered ; disease from 8 to 72 days'
duration ;
- 2 with chronic tetanus, and one of these accom-
panied by hectic fever, the other by organic
disease, namely, congestion of lungs, and
abscesses of the left lobe of the liver ;
- 1 from mortification ;
- 1 delirium tremens ;
- 1 with secondary hæmorrhage ;
- 2 one with effusion into the serous cavities, and
the other angina pectoris, both chest affec-
tions ;
- 2 from the effects of other grave injuries ;
- 1 from shock ;
- 2 from causes not known.

23 Total.

One-half died with wasting discharge and febrile action—hectic chiefly.

One-half died from supervening irregular actions, such as mortification, delirium tremens, tetanus, affections of chest complicating the hectic state,—from accidental occurrences, such as secondary hæmorrhage, and from other complicating wounds.

It does not seem that there is any peculiar tendency to the formation of purulent diseases in other organs or parts of the body,—an opinion I was in-

clined to entertain, until a more enlarged experience and a close analysis of a considerable number, proved to me that such cases were few, and probably not in any degree distinctive or peculiarly depending upon injuries of the articulation. They occur in gun-shot fractures into joints, and in fractures totally apart, nearly in the same proportion. Of twenty-two deaths from these injuries, but three give any affection of distant organs,—one angina pectoris, one effusion into serous cavities, one congestion of lungs and abscesses of left lobe of liver.

In nineteen deaths occurring in the treatment of fractures not implicating joints, three cases of purulent disease of lungs or liver were traced, and a fourth was suspected, but the cavities of the thorax and abdomen were not examined.

If we proceed, however, to consider the causes of death in the amputations, primary and secondary, performed for these injuries of joints, the cases alluded to become of much more frequent occurrence, but still, the comparison of results with merely gun-shot fractures, saves me from the error of attributing this cause of mortality to injuries of articulations especially or solely.

In the injuries of the articulations for which amputation was performed, there were twenty deaths; and in seven the chief cause appeared, after death, to be purulent diseases in distant parts.

In gun-shot fractures not connected with the joints, the number of deaths after amputation was thirty-five. In eleven, the same effects were ob-

served ; one was of doubtful character, the cavity not having been examined ; and two had pus in the blood-vessels, one in the femoral vein and artery, the other in the femoral vein alone.

Does this result depend upon the original injury ? or is it to be considered as an effect of the amputation ? The larger number after amputation must prove that the operation has a powerful influence, while the occurrence of precisely the same results in both sets of cases, in which no operation was performed, equally proves that amputation is, at least, not the only cause. Since both the injury and the amputation are each followed by these results, although in very different proportions, it seems most probable that in the greater numbers presented by amputations, the two shocks of the injury and the operation combine to produce this fatal effect.

This view is borne out by the fact, that such causes of death occur in the great majority after *primary* amputations, and not after those performed in subsequent periods, least of all in the secondary period.

In the injuries of the articulations, only one occurred after intermediate, and none after secondary amputation ; and in fractures only two cases, in like manner, after intermediate amputation. Thus the operations of the period nearest to the primary are the only ones that are followed by these peculiar effects in the series under consideration.

I dwell the more upon this point, because it is in direct contradiction to some few facts, and an ingenious theory, brought forward by Mr. Guthrie and others, in years past. By their influence they have gone far to establish the belief that these purulent diseases in distant organs are distinctive of *secondary* amputations, and such diseases have been added, accordingly, to the dangers and evils peculiar to those operations. This is a view entirely opposed to all the facts I have observed in relation to this subject. It is one of great importance, and calculated, I must believe, to lead to a conclusion so erroneous in its bearing upon the question of primary and secondary amputation, that I have felt it incumbent upon me thus distinctly to state the result of my observations.

In some investigations, made with a view to determine the effects of operations, and especially of amputations, on the system, I was led to the conclusion that the *nature* as well as the *extent* of the original shock or injury might exercise considerable influence. In such an inquiry, injuries of joints, of course, form only a small section of the subject. At some future period I hope to have the honour of submitting my views on this question in its whole bearing; but at present I merely advert to it, in reference to the predominating causes, influencing the progress and terminations of cases of joints without amputation, and after amputation, practised at different periods.

To follow out this object, the following analysis will materially assist :—

Resumé of the causes of death in the four classes.

1. Without operation ; 2. After primary amputation ; 3. After intermediary ; 4. After secondary amputations.

In the first class of 23, dying while under treatment for the original injury,

3 died with affections of the lungs and pleura ;

11 or one-half, died with wasting discharge and febrile action—hectic chiefly ;

9 or the remainder, by accidental or irregular complicating actions which supervened.

In the second class of 11, dying after primary amputation,

6 more than half, died of diseases of lungs and liver (with one exception,) of suppurative and purulent character ;

4 died of febrile action, chiefly irritative, 1 bilio-remittent, a species of yellow fever ;

1 of accidental complication, with cholera.

In the third class of 4, intermediary amputations,

3 febrile—1 bilio-remittent, 1 in which the shock of the injury never disappeared, 1 with a single tubercle and a small isolated purulent deposit in the lung ;

1 accidental—secondary hæmorrhage and phlebitis.

In the fourth class of 5, secondary amputations,

2 from shock of operation, exhausted, on second and fifth days after ;

2 hectic—1 complicated with erysipelas and diarrhoea ;

1 accidental—secondary hæmorrhage.

The legitimate conclusion from this analysis and *résumé* shows, that the chief danger and cause of death in cases treated to the end without operation, is hectic fever ; and a variety of accidental or irregular complications, such as secondary hæmorrhage, epidemics, erysipelas, gangrene, &c., combined, form the remaining half.

The cases in which amputation is performed in the first instance, with fatal result, present a very different cause of mortality : the chief agent being purulent disease of lungs or liver, and occasionally inflammatory affections of the lungs or pleura. Fevers irritative or bilious destroy more than one-third.

The deaths after intermediary amputations are chiefly caused by febrile action, irritative or bilious ; and in secondary amputations, the shock of the operations, hectic, and some accidental complications carry off the patients, already much reduced by suffering and the long continuance of wasting discharges. The results of secondary amputations, when fatal, and their causes of mortality, are in some degree assimilated to those predominant in cases treated to the end without operation.

Before I conclude the subject of mortality in these injuries, and their leading causes, I must briefly advert to the influence of external and collateral circumstances upon the progress and termination of cases treated and amputated, in proportion as those circumstances are favourable or otherwise. Under this head come the injurious effect of long transport, deficient means of treatment, bad locality, crowded or temporary hospitals, prevailing epidemics, climate, &c.

RETURN, No. III.—*Results of Injuries to Joints in cases Amputated, or treated without Operation, under favourable Circumstances. Including a Period of about Thirteen Months.*

		Results of Amputations.											Cases not amputated.									TOTAL.			
		Number of Cases.				Cured.			Died.				Number of Cases.			Cured.			Died.						
		Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Joints primarily involved.	Secondarily involved.	Total.	Primar. Inv.	Second. Inv.	Total.	Primar. Inv.	Second. Inv.	Total.	Cured.	Died.	Total.
Joint implicated.																									
HIP	Musket													2	2		1	1		1	1	1	1	1	2
KNEE	{ Cannon																								
	{ Musket	4		6	10	3		3	6	1		3	4	5	3	8	1	3	4	4		4	10	8	18
ANKLE	{ Cannon			1	1			1	1													1		1	
	{ Musket		1		1		1		1					1	1		1	1				2		2	
SHOUL- DER	{ Cannon													1		1			1	1			1		1
	{ Musket	2			2	2			2													2		2	
ELBOW	{ Cannon	1			1				1													1		1	
	{ Musket	2		1	3	2		1	3					3	5	8	3	5	8			11		11	
WRIST	{ Cannon																								
	{ Musket			1	1			1	1					2	2	4	2	2	4				5		5
Total		9	1	9	19	8	1	6	15	1		3	4	11	13	24	6	12	18	5	1	6	33	10	43

RETURN, No. IV.—*Results of Injuries to Joints in cases Amputated, or treated without Operation, under Circumstances partially unfavourable. Including a Period of about Thirteen Months.*

		Results of Amputations.												Cases not Amputated.									TOTAL.		
		Number of Cases.				Cured.				Died.				Number of Cases.			Cured.			Died.					
Joint injured.		Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Joints primarily involved.	Joints secondarily involved.	Total.	Primar. Inv.	Second. Inv.	Total.	Primar. Inv.	Second. Inv.	Total.	Cured.	Died.	Total.
HIP . .	Musket													2		2				2		2	2	2	2
ANKLE	{ Cannon		1		1		1		1					1		1			1		1	1	1	1	1
	{ Musket																								
SHOULDER .	{ Cannon	1			1	1			1					1		1			1		1	1	1	1	1
	{ Musket	2			2	2			2					1		1			1		1	2	1	3	3
KNEE . .	Musket			1	1			1	1					2	1	3	1		1	1	1	2	2	2	4
ELBOW .	Musket													2		2	1		1	1		1	1	1	2
WRIST .	Musket													1		1	1		1			1			1
Total .		3	1	1	5	3	1	1	5					9	1	10	3		3	6	1	7	8	7	15

RETURN, No. V.—*Result of Injuries to Joints in cases Amputated*
Including a Period of

Joint injured.					Results of Amputations.											
					Number of Cases.				Cured.				Died.			
					Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.
KNEE	.	.	.	Musket	3	1	2	6	1			1	2	1	2	5
ANKLE	.	.	.	{ Cannon	1			1	1			1				
				{ Musket												
SHOULDER	.	.	.	Musket	1	1		2	1			1		1		1
ELBOW	.	.	.	Musket	4			4					4			4
WRIST	.	.	.	Musket												
Total . .					9	2	2	13	3			3	6	2	2	10
Total partially unfavourable . .					3	1	1	5	3	1	1	5				
Total favourable					9	1	9	19	8	1	6	15	1		3	4
JOINT TOTALS . .					21	4	12	37	14	2	7	23	7	2	5	14

4. *Influence of External and Collateral Circumstances.*
—Returns III. IV. and V. have been framed for the purpose of showing, at one view, the relative numbers and mortality, under three classes of circumstances, which I would define as follows :—

1. *Favourable circumstances.* Cases admitted into a large, well-organised, and commodious hospital, an hour or two after the injury was inflicted, and there treated, to the end, under the same medical superintendence, and with all essential means for good treatment.

2. *Partially unfavourable circumstances.* Cases not immediately received into a well-organized hos-

tated, or treated without Operation, under Circumstances unfavourable. about Thirteen Months.

Of Cases not Amputated.									TOTAL.			
Number of Cases.			Cured.			Died.						
Joints primarily involved.	Joints secondarily involved.	Total.	Primar. Inv.	Second. Inv.	Total.	Primar. Inv.	Second. Inv.	Total.	Cured.	Died.	Total.	
7		7				7		7	1 1	12	13 1	
1	1	2	1	1	2				3	1	4	
1		1	1		1				1	4	5	
1		1	1		1				1		1	
10	1	11	3	1	4	7		7	7	17	24	Mortality about two-thirds.
9	1	10	3		3	6	1	7	8	7	15	Mortality one-half.
11	13	24	6	12	18	5	1	6	33	10	43	Mortality not a fourth.
30	15	45	12	13	25	18	2	20	48	34	82	{ Mortality about two-fifths, or 1 in 2·411.

pital, subjected to some leagues of transport, or passing part of the first period in a field hospital, with deficient means, or received into a permanent hospital, with a lax discipline.

3. *Unfavourable circumstances.* Cases admitted into crowded hospitals with epidemics prevailing, means, either personal or material, not fully adequate ; with cases of wounds inflicted after a reverse in the field, or long subjected to the deficient means, discomforts, and imperfect discipline of temporary or field hospitals, with one or two days' subsequent transport to the permanent hospital stations.

It will be seen that *under favourable circumstances*

the mortality in amputations is little more than one-fifth, or 4 in 19.

In cases not amputated, exactly one-fourth, or 6 in 24.

In primary amputations, taken separately, there is a loss of only 1 in 12, if we take the amputations in No. I., 5 of which are above the knee, and 4 at the shoulder joint.

In the two classes combined, cases treated and cases amputated, (see Return No. III.) the mortality is between one-fourth and one-fifth, or 10 in 43.

Under Circumstances partially Unfavourable.

There are only 5 amputations, and these all recovered, although 3 of the shoulder-joint and 1 of the thigh.

In cases not amputated, the mortality is 7 in 10, about two-thirds.

Mortality in the two classes combined is 7 in 15, one-half.

Under Unfavourable Circumstances.

The mortality in amputations (see Table I.) is about $\frac{7}{9}$, or 15 in 19.

In cases not amputated (see No. V.), it is $\frac{7}{11}$, or 7 in 11.

The two classes combined give a mortality (Table I.) of more than two-thirds, or 22 in 30.

No. I. has been occasionally referred to for the average on amputations, because it gives a larger number ; and as they form a complete set, i. e. they

include all the amputations performed for these injuries in the periods embraced, they do not lead to any inaccuracy of conclusion. The average founded on a larger number gives, of course, a fairer test ; and the cases treated and amputated may thus be made equal in numbers : the amputations being 49, the cases not operated upon 50. There is scarcely a variation, however, in the relative mortality of the Tables.

The evidence of these statistical results is too striking to leave any doubt whatever as to the influence which these circumstances exercise, totally independent of the constitution of the patient and the degree of injury.

The influence on the number of amputations performed at the three different periods is also a subject of interest. See Returns III. IV. V.

	Primary.	Intermediary.	Secondary.	Total Number Treated.
Under favourable circumstances	9	1	9	43
Under partially unfavourable	3	1	1	15
Under unfavourable	9	2	2	24
	21	4	12	82

Under favourable circumstances, the total number of amputations is less than one-half, nearly equally divided between the two periods of *selection*, primary and secondary. In partially unfavourable circumstances, one-fifth, *chiefly primary*; under unfavour-

able circumstances, above one-half, more than two-thirds being primary.

The proportion of amputations performed under favourable, compared with those under unfavourable circumstances, in reference to the number treated, shows the influence of these circumstances, over which the surgeon has no control, to fall chiefly upon the periods of amputation and their mortality, not upon the absolute number performed.

In favourable circumstances	19 amputations are performed in 43 cases, less than one-half; mortality on number treated 10
In more or less unfavourable	18 do. in 39 cases, less than one half also, there being only a fractional difference between the two. do. 24
	<hr/>
	37
	82
	<hr/>
	34

(See Table II.)

In each, as in the whole, the number performed is a fraction under the half ; but a small fraction of cases reaching the period for secondary amputation under unfavourable circumstances.

So, in the causes of mortality, there is no difference in the actions producing death, under these varying circumstances, sufficiently distinctive to merit especial observation. The influence here seems expended on the *number* and *severity* rather than on the *character* of the actions, which, if rendered more frequent and more fatal, are not essentially different in nature. The mere enumeration of the diseased actions to which death seemed chiefly attributable will suffice for all material purposes ; the cause of death has been determined (in a small number of the cases) without examination of the cavities after death. The deaths, amounting to 34, are thus divided :

Seven under Partially Unfavourable Circumstances.

No Deaths after Amputation.

2 diarrhœa and hectic.

2 diseases of chest.

2 exhausted ; 1 with large abscesses, and 1 with sloughs on back.

1 fever and profuse suppuration, with great disease
— of whole lower extremities.

7

Seventeen under Circumstances Unfavourable. Ten after Amputation.

2 complicated, with wounds of chest and shoulder ;
1 attacked by bilious remittent after amputation (intermediary).

12 febrile actions, variously complicated. Hectic in 3 ; irritative in 3 ; bilio-remittent in 4 ; fever of no very distinctive character in 2. Included in these are 5 cases of diseased lungs or liver, (by purulent deposits,) in all except 1, and in 2 of these phlebitis also, and 2 where the shock of amputations played a prominent part.

1 tetanus.

1 great and destructive disease of joint existing ;
no other obvious cause of death.

2 cause not known ; notes of post mortem mislaid.

Ten under Favourable Circumstances.

Amputations :

2 secondary hæmorrhage ; 1 secondary amputation,
and 1 primary.

1 disease of lungs and liver.

1 shock of injury, first day (cannon shot).

1 erysipelas and diarrhœa, secondary amputation.

Not amputated :

1 gangrene.

2 exhaustion, with sloughing action in one ; cavi-
ties not examined.

2 fever ; 1 intermittent ; 1 hectic, with diarrhœa.

10

With this review of the general results, I take leave of the tabular returns, and the statistics of injuries of joints, to proceed to the last division of the subject—the classification of particular kinds of injuries, in reference to the leading principles of treatment for each.

When injuries implicate directly the structures entering into the formation of a joint, it becomes an object of the greatest importance to determine, firstly, the character and extent of the lesion ; and, secondly, whether such mischief will ensue as shall render the attempt to save a limb not only abortive, but dangerous to life in the period of probation.

I think experience may be brought to bear in such an unequivocal manner as to supply that which

is much wanted, viz. *a definition of those kinds of direct injury, in which we shall be justified in making the endeavour to save a moderately useful limb ; justified by the actual success of a few, and by the opportunity not failing, in the majority of those in which this object is not attained, for arresting unfavourable diseased actions by secondary amputation.*

THIRD PART.

CLASSIFICATION OF KINDS OF INJURY IN WOUNDS OF THE ARTICULATIONS.

With a view to furnish data upon this part of the subject, I shall very briefly refer to some important cases which have fallen under my own care, and may be taken as types of a class, giving, however, only such description of the injury and result as may be essential to the appreciation of their bearing on the conclusions for which they form the grounds. On the treatment it does not seem necessary to dwell, after the explanation of the general principles which I consider applicable.

CASE I.

Extensive fissure into the ankle joint, from a comminuted gun-shot fracture of the bones above.* The

* The preparation was among the specimens shown.

patient lived during several months, and although the joint was not found healthy, yet no active or destructive disease had been developed. He died with an erysipelatous and gangrenous leg, effusion in the serous cavities, and general anasarca.

CASE II.

Bears analogy with the first, at the same time that it furnishes an example of another class or kind of injury. A sailor of a man-of-war steamer, in 1836, received a musket shot while rowing a boat employed in the disembarkation of troops. He was immediately forwarded to one of the hospitals, under my direction, in San Sebastian. Although there was every reason to believe that the ball had lodged in the cancellated structure of the femur, yet from the absence of any detached portion of bone, or rough fracture in the articulating surface of the bone, so far as I could ascertain, I felt warranted in an endeavour to save the limb.

In a few weeks the wound healed, and the knee, to all appearance, was undiseased; the patient only complaining of some weakness and difficulty in walking, with occasional pain; he was invalided home.

Three months ago he came to me, with a request that I would amputate his leg, for that, to use his own expression, "it so bothered him" in walking, and gave him occasionally such acute pain, that he

would infinitely rather stump about on a leg of wood. Not being attached to any metropolitan hospital, I sent him down to the Westminster, to my friend, Mr. Guthrie, who removed the leg, which, externally, presented a cicatrix, but no other mark of injury or disease, past or present.

The ball was found to have passed through the internal condyle, and presented a somewhat flattened, yet convex, smooth surface, on a level with the articulating surface, resembling a piece of metal let in. It had fissured the bone (as may be seen in a very slight and hasty sketch I made at the time),* and this fissure *had been nearly entirely filled up with osseous matter*. In four years the only mischief done to the joint was some thickening of synovial membrane, and a partial absorption of cartilages.

No very active, acute, or destructive disease had been developed, either at the time of the accident or since.

CASE III.

Has furnished the finest preparation in my collection, and requires notice here, because it presents an injury apparently similar to the last, with a very different result, depending upon an essential difference in the injury, although one easily overlooked. I need merely state, that it shows a ball lodged, somewhat rough, and slightly projecting beyond the level of the articulating surface of the femur. In

* The sketch was shown.

twenty-seven days, it produced a total destruction of all the structures of the articulation.

From these facts, which I do not think it necessary to multiply by cases of a similar type, I have drawn the following conclusions, forming the first step in classification.

1. A mere fissure of a joint, extending from a fracture, partial or complete, is not necessarily followed by severe, extensive, or destructive action in the structures of the articulation. If any other attendant circumstances, therefore, do not forbid, the attempt may be made to save the limb, with a fair prospect of a favourable result.

2. A foreign body, a musket-ball, for example, lodged either in the cancellated structure of the tibia or femur, may or may not penetrate the articulating surface, or project beyond it.

If it do not penetrate to the articular surface, it does not *necessarily* implicate the joint, or lead to any diseased action therein, and may at some later period be removed, if that be not possible at the time. If it do penetrate, but be smooth in surface, and not projecting beyond the level of the articulating surface, the same rule holds good, viz., that violent diseased action is by no means a necessary consequence, and I have been led to believe that in such a case, ankylosis, and a useful limb may, in many instances, be the result of careful treatment.

If the missile project, or if it be roughened, or cause any jagged projection of bone, the most destructive and rapid disease of the whole articulation

follows, and in the knee especially, will inevitably lead either to amputation or death. In the elbow I have known such a case saved; in the knee never.

The following is the line of practice, therefore, which it seems to me should be acted upon. When any foreign body has penetrated the end of a bone forming an articulation, the surgeon should endeavour, by finger or probe, to obtain an accurate knowledge of its position. If he concludes, after such examination, that there is no projection into the articular surface, and it cannot be removed without great additional violence to the parts, such as burying the head of the trephine deep in the spongy end of a bone, the attempt should not be made, but the limb may be treated with a view to saving it. If we fail in this, a period will probably arise favourable to the performance of secondary amputation, and to its successful issue. If the ball has, on the contrary, penetrated into the joint, fracturing its way, and remaining either fixed or loose in the articulation, there is only one chance of safety for the patient's life, and none for the limb. Immediate amputation I believe to be the best and only judicious practice. The next series of cases leads to the consideration of another class of these injuries.

CASE IV.

During an action, in the beginning of 1836, on the heights of Arlaban, seeing that one of the men, whom his comrades were removing from the spot

where he had just fallen, was wounded in the knee, I dismounted, to examine the nature of the injury, warned by frequent past experience of the value of the first half hour, before the limb has become swollen, tense and painful.

The ball had entered at the edge of the patella, and passed through the internal condyle of the femur, emerging in the popliteal space. Neither swelling nor inflammation having had time to come on, my finger easily followed the course taken, and I immediately decided on the propriety of attempting to save the limb, since I ascertained, to my satisfaction, that the ball had only forced a passage through, without breaking off any detached fragment of bone in the articulation.

The limb was lightly dressed, and he was then dispatched to the rear. At night, one of the regimental surgeons, quartered with his men in the same village with myself, came to request I would see a wounded man, whose leg, he thought, should be removed without delay.

On arriving, I recognised the patient as the man already seen. The limb was now swelled, and so greatly inflamed, that examination was no longer possible ; and had I not previously satisfied myself, very fortunately, of the exact nature of the injury, I probably should have taken the same view as my colleague, looking to the direction of the shot holes, and condemned the limb.

The next day, I had the wounded removed a few leagues to Vittoria, and took good care of him. He

perfectly recovered, and with such excellent use of the limb, that he lately walked from Liverpool to London.* A similar case occurred the following year, and with an equally favourable result.†

CASES V. and VI.

Are similar injuries, except in degree, causing greater mischief, and a less favourable termination.‡

In *Case V.* the ball passed through the tibia, a little below, and to the inner side of the head of the fibula, and several portions of the external table may be observed driven inwards into the spongy structure. The ball made its exit a little above, and external to, the tuberosity of the tibia. The patient died on the forty-eighth day. The joint was found filled with unhealthy pus, communicating with a

* He was present, and many of the Fellows of the Society examined the state of the leg.

† John Hunter relates a parallel case of recovery, where the man had no medical attendance whatever the first four days. A somewhat similar case has lately been recorded by Dr. W. Home, Assistant-surgeon to the Forces in Canada: it is published in the last number of the *Edinburgh Medical and Surgical Journal* for July 1840.

The ball entered low down in the thigh, shattered the external condyle—(I presume without detaching fragments into the articulation),—traversed the joint, and passed out between the internal condyle, and the head of the tibia: the symptoms, local and constitutional, were very severe, but, after the separation of several pieces of bone, a cure by ankylosis was finally effected.

‡ The preparations were shown to the Society.

large abscess in the leg, the whole limb infiltrated. Nevertheless, the structure of the joint was unchanged, *except in the synovial membrane, which was thickened*. The man had long laboured under chronic tetanus. The lungs were congested, the surface of the liver lobulated, and several small cavities were found, more particularly in the left lobe.*

Case VI. is of a similar kind, a musket ball having passed through the humerus, between the condyles ; the result was a bony ankylosis, and such a diseased state of bone, and soft parts, as led to secondary amputation, from which the patient recovered.

These and similar facts have suggested the following conclusion :—

When the end of a bone, entering into an articu-

* Another case, related in the last Edinburgh Medical and Surgical Journal, by Dr. Home, as lately occurring in Canada, shows the necessity of care and caution in assuming perfect similarity throughout, in seemingly parallel cases, and indeed the impossibility of prognosticating with certainty the effects that will ensue even on any well-ascertained parity of character, or extent of injury.

He relates, that a ball passed through the head of the tibia, having first fractured the fibula, an inch below its head. The patient seemed in danger of sinking from irritative fever and exhaustion, and at the end of the fifth week, amputation was performed : *it was found that no fracture had extended into the joint, nor was there any articular inflammation*. He recovered after amputation.

Many apparently similar injuries have fallen under my notice, where fissuring fractures projected into the articulation of the knee, leading to the rapid development of the most destructive actions.

lation is traversed by any foreign body or missile, more especially if it pass between the condyles of the femur or humerus, even though the integrity of the capsule, at one or more points, should be injured, if there be no detached fragment of bone, the joint, in many cases, may be saved ; and the attempt may generally with propriety be made, when no other injury or unfavourable circumstance is superadded.

CASE VII.

Brings under notice a class of injuries affecting the capsule only, or that chiefly.

Captain B., wounded in the knee at the assault of Irun, May 1837, had been conveyed across the frontier into Behobia. Amputation had been decided upon as the only resource, but the operation was deferred until the place was carried, and my duties there, as chief medical officer, allowed me to leave the scene of action to see him.

I found a musket-ball had entered at the upper and outside of the patella, and passing obliquely downwards, traversed the joint, lodging, I believe, in the neighbourhood of the joint. Although the medical officer who first saw him thought he felt it detached within the capsule, I could not, however, trace it, and my impression was that it had lodged beyond the capsule.

The swelling and inflammation supervened more slowly than usual, and I was enabled, with my finger, carefully to follow the track of the ball, between the articulating surfaces of the patella, femur, and tibia.

I could ascertain neither fissure nor fracture, and finally came to the conclusion, that the ball opening the capsular ligament had coursed obliquely across the articulation, between the surfaces of the bones, without *materially* injuring their structure. Under these circumstances, I conceived the hope of saving the limb, and so decided.

The patient recovered completely ; and so good and useful a leg is the result, that the British Army Medical Board did not conceive the permanent results warranted their recommending him for a pension ; although, I believe, he thinks himself inadequately compensated, and complains of frequent pain in the limb, he certainly walks well, and without apparent lameness.

Upon cases of this class I have drawn the following conclusion. Wounds of the capsule, and even the traversing a joint by some missile or weapon, provided neither bone nor cartilage be seriously injured, do not require or justify amputation as a first remedy. The majority may be saved, even should the motion of the joint be more or less impaired ; a useful limb may still be preserved.

Contrary to the general impression, I am strongly inclined to the conclusion, that injuries to joints are not fatal in proportion to the extent of surface laid open. The most dangerous of these wounds I believe to be punctured, or such wounds as a musket-ball creates,—a small, lacerated, and contused opening, with more or less mischief to the internal parts. The most violent inflammatory action ensues in the

highly susceptible synovial membrane, which, for a certain period, or until disorganization (the result of violent action) takes place, still retains its distinctive characters of serous or synovial membrane. Fluid is effused and pent up—the whole limb becomes involved—the system takes the alarm, and sympathises often to a fatal extent. No kindly suppurative and granulating action takes place over the surface of the synovial membrane, altering its characters and susceptibility,—a result which follows not unfrequently in a wound laying a joint fairly open, quickly destroying, of course, the texture and character of synovial membrane, and leaving ankylosis as the only favourable result possible. But under such injuries, this is the happiest result we can ever look for ; and the patient who so escapes has reason to be well satisfied that he has lost only the motion of a joint instead of a limb, or his life, or, as frequently must happen, the one first, and the other afterwards.*

* In No. X. of the Guy's Hospital Reports, the history of a gun-shot wound is given, which was under the care of Mr. Ward, of Huntingdon. The knee-joint was laid open by the contents of a fowling-piece, and a great portion of the patella shot away. A poultice was applied, *and no unfavourable symptoms*, either local or constitutional, occurred during the progress of the case. The remaining small portion of patella was subsequently removed. In three months the wound healed.

Eventually, considerable motion of joint was gained ; the cicatrix, by its firmness or cartilaginous structure, seems to have supplied the place of the patella, and the patient is reported to walk well without a stick.

This is certainly the most extraordinary case, taken in all its

CASE VIII.

A complicated case of injury to the knee, painful and embarrassing in its circumstances, and rapidly fatal in its result, occurred, a few months ago, to a young gentleman, in leaping a railing, consisting of parallel bars. His foot caught, and his body was precipitated over, while he hung, with his leg engaged between the bars, for some seconds, before he could be disengaged.

The accident happened about five o'clock afternoon, some miles from town, where he remained. The knee was partially dislocated, but speedily reduced by a practitioner on the spot. There was evident mischief to the popliteal vessel or vessels, and great extravasation, which was checked by the application of a tourniquet.

At twelve o'clock at night, I was asked to see him in consultation. My friend, Mr. Solly, his usual medical attendant, had arrived before the messenger set off, and another eminent surgeon was each moment expected. Seeing, therefore, that any measures they might think necessary would probably have been taken before I could reach, I did not see him that evening, nor until the second day after the injury. The

features, that I have met with on record. Mr. Bransby Cooper observes, that the synovial membrane in large wounds speedily loses its distinctive character ; the great shock of the injury tending also to prevent inflammation. In punctured wounds, he adds, the matter is pent up, and the synovial membrane is excited to violent inflammation : thus closely corresponding with the opinion I have given.

femoral artery, at the upper third of the thigh, had been secured. The case was looking very favourably when I saw him, and trusting that the artery alone might have been injured, and not perhaps to any great extent, there was some ground to hope that, at least, the life of the patient might be saved, and a favourable period gained for amputation.

The foot and leg mortified, commencing very perceptibly on the fifth day; after which, he rapidly sank, and died on the tenth day.

Most extensive laceration was found to have taken place. Capsular ligament posteriorly, and the crucial ligaments were torn; the semi-membranosus muscle torn from its tendinous sheath; the popliteal artery and vein nearly torn asunder; the joint, and all surrounding parts, loaded with extravasated blood; the nerve uninjured.

The patient, by his distance from town, and the unfortunate delaying circumstances, was not seen by those on whom the responsibility of the case fell, until a tourniquet had been applied, and much consequent agony suffered during several hours. The shock and disturbance to the system was great; a palliative kind of treatment, one at least that might gain time, seemed the only course that could with present safety be adopted. Had I been at the first consultation, at midnight, I think it probable such would have been my opinion. With a somewhat extensive experience in amputations, I should at all times be reluctant to resort to that operation in a patient whose nerves had been put upon the stretch

for many hours, by pain and anxiety of no ordinary character, if by any other measure these could be for a time, or in a great measure removed. Rarely, indeed, have I seen such cases do well.

In a similar accident, under more favourable circumstances, that is to say, when the patient could immediately receive such surgical relief as might be decided to be the best, what should be the rule of practice?

Few more embarrassing accidents could occur. In the first place, the exact nature of the injury, and its extent, can only be very imperfectly estimated by the external appearances, and the degree of force, and mode in which it was applied. These are our only guides, and very insufficient ones. An external wound would make the case much simpler of diagnosis, and by so much a safer injury.

From the mode of the accident, I should be inclined to fear that the violence that would suffice to dislocate the knee, at the same time rupturing the popliteal artery, would also either have ruptured, or so far injured, by extension, the vitality of the vein, as to prevent circulation, and lead to the coagulation of the blood within its tunics, when, of course, amputation becomes imperative.

On the other hand, if such were not the case, we incur the risk of removing a limb which admitted of successful treatment. An incision down to the ruptured vessel, and the application of a ligature, might place the patient in a favourable state, provided this additional violence did not bring on such excessive

inflammatory action in and about the articulation as to lead to some disastrous result. If the vein were found injured, or extensive laceration, as in this case, of the synovial capsule, with great extravasation of blood, the patient would only have undergone a somewhat protracted operation, the termination of which would necessarily be amputation.

I have been led to the following conclusion, as, under all the circumstances, most likely to prove the safest practice.

When there has been great violence offered to an articulation, sufficient to produce dislocation, and evident injury to a large blood-vessel in the vicinity, an incision should be made down to the vessels, and the nature and extent of the injury ascertained. If the artery alone be implicated, the capsule not extensively lacerated, nor blood extravasated within, a ligature may be placed above and below the ruptured point of the artery, and the case treated with a view to saving the limb. If any of these adverse circumstances be found, amputation should be proceeded with.

CASE IX.

At present in the Westminster Hospital, under the care of Mr. White, is one of unusual interest, forming an example of a different kind of complicated injury to any I have hitherto noticed.

The patient is a child, aged six years and a half, and was admitted nearly nine months ago for a very

singular injury to the knee, occasioned by his getting his leg entangled in the wheel of a cabriolet, behind which he was riding.

A large lacerated wound extended across the ham, from one condyle to the other, through which the shaft of the femur, separated from its epiphyses, and denuded of periosteum, protruded, projecting as far downwards as the middle of the belly of the gastrocnemius muscle. The epiphyses retained *in situ*, and the patella uninjured. It is believed the capsule must have been opened merely from synovial-like fluid issuing, for some time after, from the wound.

Reduction was found impossible, and Mr. White determined on endeavouring to save the limb by sawing off a portion of the protruding shaft, and then reducing the remainder: this was done. The artery, vein, and nerve were found to be, *anterior* to the bone, uninjured. The reduction was now easily effected; five sutures were used, wet lint and a roller applied, and the limb was laid on the side, in a semi-flexed position, and secured by a splint.

This position was altered the next day, by his slipping partially through the opening, for the bed-pan, in the bed, and the limb was both disturbed, and flexed upon the thigh.

He has now got through a hard struggle for his life. The joint does not seem materially to have suffered. There is motion in it; but the leg is at an angle of about seventy-five with the thigh, and though with crutches, or with stooping, he can

get forward, and rest some weight upon it, a large piece of the shaft is evidently undergoing exfoliation, a corner of dead bone projecting at the wound. From the limb not being straight, though the case forms a wonderful instance of recovery by the exercise of bold surgery, it is doubtful how far the limb will be useful: but it is premature to decide upon that point yet; and in so young a child, during growth, nature may work still further wonders.

The joint was in very slight degree directly implicated, I have little doubt; and it has not been materially damaged by any subsequent diseased action, notwithstanding the terrible laceration across the popliteal space. I am led to believe that had the bone not been stripped of its periosteum, to which circumstance the exfoliation may be mainly attributed, and had the limb been maintained in a straight position,—a great difficulty, however, in so young a child,—there was every reason to anticipate in this, or a similar injury, without those two unfavourable circumstances, *a successful issue, in the shape of a good and useful limb*. If, from the wide gaping of the wound or other causes, the straight position were found untenable, I should decide for amputation, since I believe a lower limb much bent to be a greater evil than its total loss by amputation, although I admit the peril of an amputation being avoided is a consideration in favour of the palliative treatment.

CASE X.

It is often difficult to decide upon the course to be adopted in wounds and laceration of the wrist. It is now some months ago that a man was admitted into the same hospital, a circular saw having entered immediately below the carpal articulation, sawing off partially the heads of two or three of the metacarpal bones, with considerable laceration of soft parts; the detached portions of bone were removed, and the parts gently dressed.

Violent inflammation and suppurative disease ensued, involving the whole hand and lower part of the fore-arm. It remains yet a question, whether he will ever obtain the use of even a pair of pincers, in the fore-finger and thumb; the rest of the fingers, I should fear, were permanently disabled; a great deal of swelling, consolidation, and some suppurative disease still continuing, and no power or motion perceptible from the wrist downwards.*

I have seen the wrist recovered, in other instances, from an apparently worse character of injury, such as the passage of a ball through the carpal bones inflicts. These are cases, as I have observed, eminently uncertain in their results.

* Five months have now elapsed; he has long been out of hospital; the hand is still in a swelled and very diseased state, with a sinus from which discharge proceeds.

CASE XI.

I shall allude to one more case only. A gentleman, in 1835, was thrown out of his gig, and fractured the upper third of the ulna into the elbow joint. He was a stout muscular man, and considerable swelling supervening, before his surgeon saw him, the fracture did not seem to have been discovered until some degree of union had taken place, and that at such an angle, that a sharp peak projected at the posterior surface, rendering any attempt at flexion painful in the extreme, "cutting like a knife," as the patient described, from the stretching of the skin over the sharp end of bone.

Returning from abroad, for a few months, after the close of the civil war in Portugal, the patient, who was an old friend, begged me to examine his arm, and take charge of him, if I thought anything could be done. Gentle passive motion and friction had been adopted, but the time had arrived, it appeared to me, when more force was required, and no perceptible advantage could be obtained without it.

I founded this opinion upon my diagnosis, that mere ligamentous bands, uniting the two fragments at an angle, prevented the flexion of the arm, and that it required regulated, but considerable force, to elongate these. Before it could be attempted, the sharp projecting end of bone required removal.

As he had received different opinions from other

medical men, some his personal friends, I advised him, before any thing was done, to come up to town, that I might consult one or more of the leading surgeons. Our president, Sir B. Brodie, may perhaps remember seeing him with me. The patient consulted also Sir Astley Cooper, who took the same view of the case that I had done.

I removed the projecting end of bone, and as soon as the incision was soundly healed, I employed, morning and evening, a moderate degree of forcible extension, gaining by measurement, a very little each two or three days, but never proceeding so far as to excite inflammation. The case rapidly improved, and he has long recovered the perfect use of his arm, can carry his hand to the shoulder of the same side, row, &c., without pain or difficulty.

Cases of this kind have led me to the following conclusion. Wherever a partial ankylosis takes place, proving that there is not that kind of bony union, (of which there is a fine example among the specimens,) and no fragment of bone locks, so as to give the conviction, that unless it be broken, no farther progress can be made, the limited motion will generally be found to depend upon ligamentous bands or adhesions, which will elongate by the judicious use of force, to be employed twice daily, neither violent, nor long continued, but so as perceptibly to gain by measurement, something, however little, each two or three days. In such cases, the gentle kind of passive motion, together with the frictions generally recommended, are perfectly in-

adequate, and altogether useless, except during the first few days after union, to facilitate the absorption of the effusion and thickening which may remain in the soft parts.

In conclusion, it is evident, that there are many different kinds of injuries to joints, independent of all other varying circumstances which influence the progress and termination of a case. Although it may be difficult or impossible to lay down rules which shall provide for every contingency or possible complication, yet the injuries according to their nature, and the leading principles of treatment applicable to each class thus defined, may be established in a clear and comprehensive manner, and one important step taken towards the simplification and improvement of our knowledge.

These injuries I have been led to class in the following manner, in reference to the principle of their treatment. Instances of the greater number I have just related, and the conclusions on which, it has seemed to me, their treatment should be based.

First Class.

1. Incised or lacerated wounds penetrating the capsule.
2. Penetrating wounds, with partial abrasion or contusion of articulating surfaces.
3. Simple fractures into joints, with more or less displacement, and subsequent confined ligamentous union.
4. Fissuring of articulating surfaces, from com-

pound fractures, complete or partial in the vicinity, but without displacement of bone within the capsule.

In this first class are included those cases, the great majority of which may be saved, and when it should be a principle of practice to attempt it. Of course, in the last division, fissuring from compound fractures, much judgment is required, to determine the curability of the fractured limb; the rule laid down is applicable only *quoad* the articulation. Moreover, in cases of fissuring from compound fractures, it will often happen, that only the head, or head and neck of the bone may be seriously damaged, and this, either with or without a foreign body lodging. Several fine specimens of this kind of injury are among my preparations. Here the limb may be frequently saved, as I have already shown, though not the joint, by excision of the head of the bone, or removal of the fragments.

Second Class.

1. Foreign bodies lodged in the ends of bones, either not presenting in the articular surface, or on the same level and smooth.
2. Foreign bodies traversing the ends of bones, without detaching fragments from the articular surfaces.
3. Internal laceration of ligamentous structure, with lesion of blood vessels, and with or without temporary displacement of articulating surfaces.

4. Separation of shaft from epiphyses with possible laceration of capsule, but not extensive.

This second I have described as an *intermediate class*, ranging between those in which the principle is laid down that the limb may be saved, and those included in the third class, where the contrary rule holds, viz., that the attempt to save should not be made.

The intermediate class includes four kinds, like the first : and these of all the injuries to joints require the most accurate diagnosis and sound judgment in determining the line of practice, whether to attempt to save, or, at once, to condemn. I have succeeded in saving many of this class, but it certainly is not always judicious to make the attempt ; and therefore have endeavoured to establish certain conclusions, having particular reference to the principles of decision to be adopted in the varieties in this class.

Third Class.

1. Compound fractures into joints, with displacement and roughened edges.
2. Foreign bodies projecting into articulation, or traversing with extensive injury to structure.
3. Lacerated wounds of capsule, with much contusion and injury to internal structure of articulation, and with extravasation of blood into the joint.

The third class includes those kinds or varieties

of injury, amounting to three, in which the principle of practice should be to amputate without delay, unless excision of the articulating ends be judged advisable. The injury being of an irremediable character, the system, from the first moment takes the alarm, and each succeeding hour diminishes the power of the patient, rapidly involving, not only the joint, but often the whole limb, in a hopeless suppurative and disorganizing action.

I have alluded to a case under my own care, in which an anchylosed limb was saved, in an injury of the elbow, coming within the definition of the first kind in this class, viz., compound fractures into joints, with displacement and roughened edges. But this was by means of partial excision, and, except in the lesser articulations, the hand or foot, this is the only favourable case I have met with ; such a result may be obtained, in the ankle, under very favourable circumstances.*

In the second kind, viz., foreign bodies projecting into articulations, or traversing them with extensive injury to the structure, I have never known a recovery to take place, in any of the large articulations—more particularly the knee and shoulder ; and very rarely in any of the smaller joints, such as those of the wrist, hand, and foot.

An extensive injury to a joint will sometimes destroy the patient by the shock. Or a wound of an

* A favourable case of this nature, at present under observation, is now rapidly recovering after partial excision ; the system never having sympathised to any alarming extent.

articulation may be complicated with some other grave injury ; such as a penetrating wound of the chest. Unless the second wound be of fatal character, I do not think it should prevent the necessary steps being taken with reference to the joint. In one such case, I amputated at the shoulder joint, and although the patient ultimately died, having been seized with a bilio-remittent fever, which attacked nearly all the amputations of the period, he did not die till the thirty-first day : the *lung*, however, *presented no trace of active disease*, although the wound was in the chest, the morbid actions seemed to have been expended upon the vicinity of the articulation.

The most excessive action sometimes follows a slight injury, and I have known erosion of the cartilages take place in five days. In another case, a superficial wound of the inside of the knee seemed to develope the most frightful actions, local and general, destroying the limb with suppurative disease, and consuming all vital power by fever. The ball which had curved down towards the ham-strings, but still superficially, I removed on the sixth or seventh day, and he died about the fifteenth.

At other times there will be, comparatively, little action in the joint itself, and the whole mischief be expended below ; or again, I have known a joint filled with pus, but no erosion or alteration whatever in the cartilages.

It is worthy of remark, also, that a joint often becomes secondarily affected, and with so little at-

tendant pain, as to escape observation for some time.

With these brief hints on the irregular or less usual effects of these injuries, which seem to follow no certain law, and therefore may baffle the most judicious prognosis, I must close my observations.

The facts and conclusions on which the opinions here given have been founded, are the fruits of some experience and opportunities of observation, on a scale not easily or generally obtained. Many remarkable and successful cases have tested such of these opinions as lead to the attempt to save a limb, which, in these injuries, if injudiciously resolved on, too often terminates fatally for the patient's life. A feeling already exists, sufficiently general, that all severe injuries to joints require amputation. Nevertheless while my object has been to define with accuracy certain kinds that admit of treatment with a fair prospect of a useful limb as the result, I have endeavoured to furnish the necessary data to guard against any possible error of an opposite nature; the tendency of which might be to lead to the attempt to save a limb, in cases deservedly esteemed hopeless.

I trust these observations may contribute, in some degree, to fix the principles of treatment, especially as relates to amputation and excision, applicable to the various kinds of a class of injuries of common occurrence in civil and military life, of great interest and importance, yet, hitherto, but lightly dwelt upon by surgical writers in civil practice.

